

The Genera and Species of the Order
Euphausiacea,
with Account of remarkable Variation

BY

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I. INTRODUCTORY REMARKS.

Since 1904 the author of this treatise has examined a vast number of Crustacea Euphausiacea from all oceans. The material originates from the following expeditions and Museums: the Danish « Ingolf » Expedition, the explorations of the « Thor » until 1906, the cruizes of the Prince of Monaco, the « Siboga » Expedition, the Belgian and the Swedish Antarctic Expeditions, the exploring voyage of Professor Agassiz 1904-5 in the East Pacific, the expeditions of the « Travailleur » and the « Talisman », the Copenhagen Museum, the U. S. National Museum, the British Museum (containing above all the « Challenger » collection), besides some material from the Bering Sea and the North Pacific belonging to the Imperial Zoological Museum in St. Petersburg and the University of California; finally some interesting animals received from the English Zoologists T. R. R. Stebbing, E. W. L. Holt

and W. M. Tattersall. Various results of my study have been published in several (6) papers, among which those being Nos. 30 and 42 of this Bulletin (1905) and the «Siboga» report (1910).

The really broad foundation of our knowledge of this order was laid by G. O. Sars in his «Challenger» work. It ought to be said that in spite of a number of imperfections or errors in matters of detail it ranks very high by the enormous quantity of observations based on a comparatively large and varied material and set forth by the author in his lucid text and very large number of generally good figures. Sars described 28 species (almost all new), but 3 have been cancelled later, so that 25 remained; 5 valid species from the North Atlantic and the Arctic Ocean and 1 species from the Sea of Ochotsk had been established by earlier authors and were not described in the «Challenger» work. The result is that at the end of 1885 31 species now recognized as valid were known. During the next 25 years (1886-1910) several authors have added in all 30 valid species (4 established by Calman, Holmes, Illig and Stebbing, 3 by Holt and Tattersall, 6 by Ortmann and 17 by myself). And here I give preliminary diagnoses of 12 new species, so that the total number now known of this order is 73 species.

For various reasons I am apt to think that comparatively few, probably not a dozen, species in the oceans of the globe are still undiscovered. Excepting the South Pacific, from which my material is somewhat scanty, I have examined large or even very rich collections from every large area of the oceans, and no single expedition or Museum contained more than at most two species not found by me in at least one collection from another source. Furthermore the animals are easily captured by tow-nets or vertical nets, and such instruments have been much used by most exploring expeditions since the «Challenger». And the majority of species have a very wide geographical distribution. It is of importance that I have

seen specimens of every valid species hitherto established in the whole literature. Finally it may be pointed out, that a good number of the species established here and in my earlier papers had been seen by earlier authors but were not recognized, being mixed up in one way or another or wrongly named, consequently the number of species seen only by me is considerably lower than the number established as new in my papers, and this increases the probability that comparatively very few species of the world's fauna are still undiscovered.

It may be mentioned, that it is a more close examination of the antennulæ and above all the investigation of the male copulatory organs as attempted in the « Siboga » report which helped me to separate the real species with so much certainty that I feel confident as to the results, thinking that a personal conception as to the limitation of species is now nearly or totally out of question.

The aim of the present treatise is to give an enumeration and a kind of abridged view of all genera and species of the order, with short preliminary descriptions of the new species and of some closely allied, already established forms, the diagnoses of which were imperfect or incorrect in points of importance. Furthermore notes on other species, some analytical keys and divisions into groups are added together with observations on sexual differences, etc. In order to avoid unnecessary reiterations the descriptions of several genera and of a good number of species in the literature are deemed sufficient for my present purpose, and I confine myself to references to the paper most essential as to the animals in question. Very brief statements on the distribution of numerous species are added, but an exhausting account of this topic would occupy too much space. A few remarks on synonymy are given, but as to this topic and the cancelling of some names for other reasons my « Siboga » report together with Dr. Zimmer's Schizopoden (1909) contain nearly exhausting statements ; it may be added here that *Thysa-*

nopoda elongata Guer. must be cancelled, as the description (with figures) is quite insufficient for the recognition of the species, and the type has disappeared. I thought it useful to write this treatise, as a few years may elapse before all reports on the collections to hand can be published, and as several Zoologists are occupied with the study of material of this order.

Finally the chapter on variation. While writing this paper I was forced to examine more closely *Rhoda inermis* Kr. and *Thysanoëssa neglecta* Kr., as at least three times since 1885 I had met with difficulties in referring several specimens to either of these species. And the result of the new investigation was somewhat startling, showing a variation of a quite unusual quality. Consequently I deemed it practical to deal with this topic in a separate chapter, and to add a short account of some other cases of interesting variation, omitting all differences arising from age, sex or pure anomalies. And I write this chapter in the hope that it may be of some interest to several Zoologists besides those occupied with an investigation of animals of this order.

II. REMARKABLE VARIATION.

A. *Variation in Carapace or Abdomen.*

1. In 1894 Ortmann established *Euphausia diomedæ* on a couple of specimens from the Pacific possessing a peculiar character, viz. a quite extraordinary expansion of the frontal plate «arched over the eyes, and covering their peduncles», while the rostral process is very short. As already mentioned in the «Siboga» report, I have a large material from the Indian Archipelago and a very large number of specimens from the East Pacific of this species, but all specimens from the Dutch India and most from the Pacific have the frontal plate not covering

the eye-stalks, and the rostrum slender and moderately long as in some allied forms of the genus, while some of the Pacific specimens of both sexes have the frontal plate with rostrum developed fully or even more anomalously than in the specimen figured by Ortmann, and some other specimens show connecting links between the normal and the aberrant shape. These intermediate stages together with the fact, that the specimens with the frontal plate greatly expanded agree in every other feature — the structure of the male copulatory organs included — with the specimens possessing a normal frontal plate with slender rostrum, prove with absolute certainty that all specimens belong to the same species. The sketches convey better than any explanation an idea of the very different aspect of the two « forms » of this species.

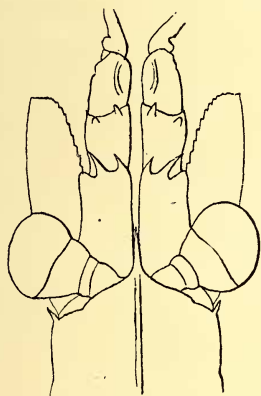


FIG. 1. *Euphausia diomedea* Ortm.
Anterior part of a normal male
from the Indian Archipelago.

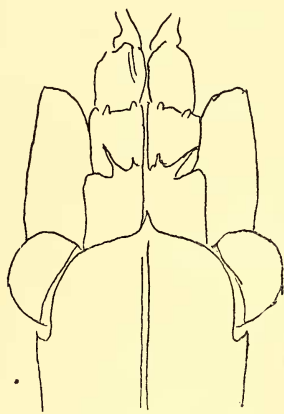


FIG. 2. *Euphausia diomedea* Ortm.
Anterior part of a male with
the frontal plate expanded, East
Pacific.

And this variation in *Euphausia diomedea* Ortm. is not without parallel within the same genus. In *E. triacantha* Holt and Tatt., of which numerous adult specimens are to hand, the frontal plate is rather short, covering only the base of the eye-stalks, and produced into a rather long or long rostrum. But in an adult female the plate is

much longer, very considerably expanded with convex lateral margins and covers most of the eye-stalks, while rostrum is short. Another adult female shows a feeble degree of the same development.

It is certain that these instances of strong variation are not mainly, or perhaps not at all, geographical but individual, and they cannot be considered as cases of accidental deformity. Variation in the degree of development of processes etc. is well known in many Amphipoda, but it is frequently connected with variation in size of the animals, often arising from differences in salinity or temperature. At all events such variation cannot be compared with that found in the two species of *Euphausia*, where the thing is, that in some few specimens of normal size and of both sexes a single and conspicuous organ not serving any appreciable purpose is developed in a quite unusual way. And I am not aware that variation in any way comparable with that in the specimens of the two species of *Euphausia* is known within any other group of Crustacea. It may be added that of several other species of the same genus I have determined from a hundred to some hundred specimens of each species without observing a single case of expansion of the frontal plate.

2. A number of specimens of *Euphausia similis* G.O.S. from the South Atlantic, the Indian Ocean and the Pacific have the frontal plate and rostrum developed in the normal way. But all three immature specimens of this species from a locality in the Indian Archipelago have the frontal plate with rostrum and besides the gastric area anomalously vaulted, with the plate larger and the rostrum shorter than in normal specimens; the aberrant animals have been described and figured in the « Siboga » report. Though the general aspect of this variation is different from that in *E. diomedea*, the case may be analogous, but as all my specimens from that locality and area show the vaulting, which is comparatively much more developed in the largest than in the smallest specimen, I do not venture to draw any conclusion.

3. Implicitly it has been taken for certain by all authors that the presence or absence of a spiniform dorsal process from the hind margin of third abdominal segment in *Euphausia*, etc., is an excellent specific character. But later in this treatise it is shown, that all specimens of *E. similis* G. O. S. mentioned in the literature and those from several localities in three oceans seen by me have no such process, while all my 11 specimens from four localities extremely distant from each other have a well developed, compressed process continued forward as a short keel. This seems thus to be variation of local nature, but certainly it originates in places very distant from each other, and from one locality the adult specimens are small, from another very large. A somewhat similar, but less pronounced case has been observed by Tattersall and later by myself in *E. Vallentini* Stebb., which generally possesses an extremely thin process from the third segment, and this process is easily broken off, but in some specimens it has seemingly not been developed.

4. Among the numerous species found both in the Atlantic and the Pacific and besides not infrequently known from the Indian Ocean only three or four show any appreciable geographical variation. The variation in *Thysanopoda pectinata* Ortm. is mentioned below. And the most peculiar variation of this kind is found in two species of *Nematoscelis*. Adult males of *N. microps* G. O. S. and *N. tenella* G. O. S. from the North Atlantic have a distinct denticle posteriorly on the lower margin of the carapace, but in males from the East Pacific this denticle is wanting, while it is found in males from the Indian Archipelago, though in *N. tenella* from this area it is very small. Furthermore the rostrum of both sexes of *N. microps* shows both purely individual and distinctly geographical variation, as mentioned in the « Siboga » report.

B. *Rhoda* and *Thysanoëssa*.

According to the general conception the genus *Rhoda* Sim. (*Boreophausia* G.O.S.), comprising only two species, has the eyes circular and the anterior pairs of thoracic legs quite similar to each other, slender and with thin setæ from near the base to the end, while the old genus *Thysanoëssa* Brandt is quite dissimilar in aspect, having the eyes higher than broad, divided by a transverse constriction into two areas, and the first pair of legs very different from the second, conspicuously stronger and much longer, with fourth and fifth joints elongate and partly naked, sixth and the very short seventh joint furnished with rather strong or even nearly spiniform setæ. Holt and Tattersall have even referred *Rhoda* to their subfamily *Euphausiinae*, *Thysanoëssa* to the *Nematoscelinae*. It shall now be shown that *Rhoda inermis* Kr. and *Thysanoëssa neglecta* Kr. (= *T. borealis* G. O. S.) are variations of the same species.

Rhoda inermis Kr. is common in the most northern temperate and the boreal Atlantic, in the adjacent area of the Arctic Ocean and not uncommon in the most northern Pacific. The eyes of the adults are never really circular, but feebly narrowed upwards and slightly higher than broad, ovate, and a division into an upper small and a lower large area is sometimes discernible; in half-grown specimens the eyes are somewhat higher than broad and generally distinctly divided into two areas. Two excellent specific characters are well known; that the carapace has no denticle on its lower margins, while the sixth abdominal segment has a well developed spine above at the end. (In nearly all specimens from the North Atlantic the fifth abdominal segment has no dorsal denticle, but among several adult specimens taken off Cape Cod one specimen has such a denticle very small and in another it is well developed; this denticle seems to exist in all specimens from the North Pacific).

The two anterior pairs of thoracic legs agree completely with each other in thickness, length of the joints and their long, fine and plumose setæ. The exopod of sixth pair of legs is normally developed as to shape, division and setæ; in the adult males an endopod is quite wanting, while in adult females the endopod is articulated in the usual way to the broad inner distal part of second joint of the leg, and this endopod is unjointed, reaching either to the end of the long proximal joint of the exopod or somewhat beyond that end to the middle of the setiferous part of the exopod. The exopod of seventh pair of legs is somewhat styliform, naked; an endopod is wanting in both sexes. Furthermore the antennulæ in the adult males have the peduncles quite dissimilar from those in the females and besides differing much from those in any other species of the order; they may be described here, and the left male peduncle, seen from the outer side, has been figured by G. O. Sars (15, Pl. I, Fig. 15). The first joint of the antennula has towards the inner margin a high, compressed lobe directed more in the longitudinal than in the transverse direction, and along its upper subhorizontal margin furnished with a close row of long, somewhat curved spines. The second joint is thick, with the upper outer distal angle produced in a long, protruding, sinuate, somewhat slender process, while at the upper inner angle one finds a compressed, moderately short process directed essentially forwards and with a row of fine and long setæ along its terminal margin. Third joint is slender at the base, but more distally with a very high, long, dorsally rounded upper keel. It may be added that the terminal process of the copulatory organs has its major distal part flattened and rolled up as a long tube with a split along its posterior side.

Thysanoëssa neglecta Kr. has nearly the same distribution in the North Atlantic and the Arctic as *Rhoda inermis*, but it is not known from the North Pacific; it is on the whole less common than *R. inermis*, the great

majority of the specimens seen by me are immature and the material in the Copenhagen Museum does not even contain any adult male, but several adult males are found in the collection of the U. S. Nat. Museum. The eyes of the adults are sometimes slightly ovate and without constriction, but generally conspicuously higher than broad and frequently with a discernible constriction ; in younger specimens the eyes are somewhat or considerably higher than broad, with the constriction frequently well developed. As in *R. inermis* the carapace has no lateral denticles, sixth abdominal segment has a terminal upper spine ; sixth and seventh pairs of thoracic legs as in that form. The first pair of legs, developed as prehensile organs, must be dealt with more explicitly.

In a large number of from less than half-grown to not quite full-grown specimens taken off South-Iceland the prehensile legs are long and very strong, with the fourth joint reaching a little or somewhat beyond the end of the antennular peduncles ; these legs have second and third joint and the proximal part of the elongate fourth joint exceedingly thick as compared with these joints in second pair ; the distal part of fourth joint and the major proximal part of the elongate fifth joint are nearly naked, while the distal part of fifth joint has a few short, nearly spiniform setæ on the lower margin ; the seventh joint is as broad as the strong sixth, much shorter and thicker than in second pair, and the setæ on sixth and seventh joint are naked, stiff, nearly spiniform. These prehensile legs are thus extremely different from the corresponding pair in *R. inermis*.

In adult females taken off Cape Cod the prehensile legs are about as in the specimens just described, with their fourth joint reaching somewhat beyond, or only to the end of, the antennular peduncles. In several subadult specimens taken, together with a number of *R. inermis*, at a station off South-West Iceland, the prehensile legs vary much in length with corresponding thickness ; in one

specimen the fourth joint reaches the middle of third antennular joint, and the whole leg is a good deal less robust than in the above-mentioned specimen but agreeing tolerably as to setæ; in a second specimen the fourth joint reaches scarcely the end of second antennular joint, in a third specimen only a little beyond the end of first joint, and in a fourth specimen scarcely to the end of first joint. In the last-named specimen the prehensile legs are evidently, but not much, stronger and only a little longer than second pair; the setæ of the fifth joint are proximally less developed, but otherwise both on this and on the major proximal part of the sixth joint distinctly plumose and slightly or scarcely thicker than on second pair; the seventh joint is somewhat shorter and slightly or scarcely thicker than in second pair, but its setæ are nearly spiniform, while they are longer and thinner on second pair. In a fifth specimen there is no other difference between first and second pair of legs than the seventh joint, which in the first pair is conspicuously shorter and with its setæ a little stronger than in the second.

From a station in the « Wood's Hole region » (U. S. Nat. Museum) I have five adult males of *T. neglecta*, all with the antennular peduncles agreeing completely with those in *R. inermis*. In one specimen first and second pair of legs are quite similar in all respects, excepting that the seventh joint is a little longer in the first than in the second pair. In a second specimen the fourth joint of first pair of legs reaches the middle of second antennular joint, is somewhat longer and considerably stronger than the second pair, and the specimen is thus almost a typical *Thysanoëssa*; the three other males have the development of the prehensile legs intermediate between those of the two other specimens, and an adult female from the same station agrees in the development of first legs completely with the first-named male. And it must be emphasized that the only difference found in any organ between the first-named adult male and a male of *R. inermis* from

another locality is that the seventh joint of first pair of legs is a little shorter than in the second pair, while these joints are of equal length in *R. inermis*.

This detailed investigation proves that it is possible to find in the development of first pair of legs every degree, every connecting link, between normal specimens of *Rhoda inermis* and specimens of *Thysanoëssa neglecta* with the first pair of legs much elongate, strongly thickened and the number, length and thickness of setæ very altered; furthermore that adult males of both « forms » agree completely with each other in all features — excepting the anterior legs — though the terminal process of the copulatory organs is very peculiar and their antennular peduncles more modified, more richly furnished with processes, spines and setæ than in any other male of the order.

And the results are, that *Rhoda inermis* Kr. and *Thysanoëssa neglecta* Kr. (*T. borealis* G. O. S.) are in reality the same species, that the two genera must be united, that *Rhoda* cannot be maintained, as no generic difference can be pointed out between *R. inermis* and the single other species, *R. Raschii* M. Sars, finally that according to the rules of priority the name *Rhoda* must be dropped and the species be named *Thysanoëssa inermis* Kr.

It is, I think, without parallel among Arthropoda that in the majority of the specimens of a species the legs are normal, while in many specimens of both sexes, and at least as much in young as in adults, one pair of legs are developed more or less as a kind of prehensile organs, frequently even much elongate and strongly thickened. The case may be compared with the interesting mutations among the family Atyidæ first discovered by Bouvier and quite recently excellently discussed by Dr Calman (1), but the differences

(1) W. T. CALMAN : The Researches of Bouvier and Bordage on Mutations in Crustacea of the family Atyidæ (Quart. Journ. Micr. Sc. Vol. 55, p. 785, 1910).

between the two cases are so conspicuous that no mention is needed. And having attempted to put all necessary details before the reader I will abstain from any discussion or speculation.

It may be added that in *Thysanoëssa spinifera* the eyes are a little higher than broad, a little narrowing upwards but without any perceptible constriction; first pair of legs vary rather inconsiderably, being scarcely or a little longer and slightly or conspicuously stronger than second pair; seventh joint is a good deal shorter and somewhat thicker in first than in second pair, and the setæ along the lower margin of sixth joint are nearly or quite naked in first pair, distinctly plumose in second pair. But I have not found any specimen with the first pair of legs developed either as in the « form » *Rhoda inermis* or as in specimens of *T. inermis* with the same pair strongly thickened. Of the species hitherto named *Rhoda Raschii* M. Sars I have not seen any specimen with the first pair of legs developed as in a typical *Thysanoëssa*; in all other species of *Thysanoëssa* not already mentioned in this chapter I have always found the first pair of legs conspicuously longer and at least somewhat stronger than second pair, but at least in several species the first pair of legs vary somewhat or even much as to length and thickness in specimens of the same species.

III. GENERA AND SPECIES.

Bentheuphausia G. O. S.

Only one species, *B. amblyops* G. O. S., is known. Sars' account (16) of this bathypelagic and widely distributed form is excellent.

Thysanopoda H. M.-Edw.

(**Parathysanopoda** Illig).

Parathysanopoda foliifera Illig was established 1909 (12) on a single Atlantic specimen measuring 15 mm. in length. The only generic difference from *Thysanopoda* is that the cornea of the eyes is divided into a smaller frontal and a larger lateral part. But in the « Siboga » report I showed that the same is the case in very young specimens of *Thysanopoda orientalis* H. J. H., and I am able to prove that in very young specimens of *T. pectinata* Ortm. the eyes show the same feature. The genus *Parathysanopoda* is in reality to be cancelled as based on a juvenile character. And Illig's description and fig. 2 of his *P. foliifera*, especially the lobe from first antennular joint, agree so well with quite young specimens of *T. pectinata* Ortm. examined by myself, that I am quite sure that his specimen belongs to this species.

Quite recently I have arrived at the result that *T. Agassizii* Ortm. cannot be maintained as a species different from *T. monacantha* Ortm. (comp. the remarks in the « Siboga » report). And in September 1908 Illig cancelled *T. megalops* established by himself (10) a few months before on two mutilated specimens ; unfortunately he does not give the name of the species to which his form ought to be referred,

but judging from various particulars on his two drawings I am apt to think that he had examined specimens of *Euphausia lucens* H. J. H.

In No. 42 of this Bulletin I described a large adult female from the Monaco collection of *T. pectinata* Ortm. The Agassiz material from the East Pacific contains a good number of adult specimens of a form, which is considerably smaller than the specimen from the North Atlantic and differs in having the frontal plate nearly triangular or only narrowly rounded at the front end, while this plate is very broadly obtuse in the Atlantic specimen. During years I considered the Pacific form as a separate, though closely allied, species, but recently I received a large and a considerably smaller male, both adult, together with some adult females captured in 1910 by the Prince of Monaco, and an examination of the copulatory organs does not reveal any difference in these most important organs between specimens from the Atlantic and the Pacific. As the only real difference between my specimens from the two oceans is that the frontal plate is less produced and more broadly obtuse in the Atlantic specimens than in those from the Pacific, I am forced to refer all to *T. pectinata* Ortm.

- a. *Carapace without any distinct cervical groove.*
Sixth abdominal segment longer than the fifth.

The following species belong to this group: *T. tricuspidata* M. Edv., *T. cristata* G. O. S., *T. monacantha* Ortm. (= *T. Agassizii* Ortm.), *T. æqualis* H. J. H., *T. obtusifrons* G. O. S., *T. pectinata* Ortm., *T. microphthalma* G. O. S., *T. acutifrons* Holt and Tatt., *T. orientalis* H. J. H. In the five first-named species the carapace has a denticle on the lower margin towards its posterior end, while in the four other species no such denticle is found in adult and subadult specimens, though present in very young specimens.

- b. *Carapace with a well developed cervical groove.*
Sixth abdominal segment shorter than the fifth.

This group comprises only two species, viz. *T. cornuta* Illig and *T. egregia* H. J. H.

For reasons given above *T. elongata* Guer., *T. megalops* Illig, *T. Agassizii* Ortm. and *Parathysanopoda foliifera* Illig are cancelled or reduced to synonyms ; all other synonyms are given in the « Siboga » report, which besides contains remarks on or descriptions of all species of the genus excepting *T. pectinata* Ortm., *T. cornuta* Illig and *T. egregia* H. J. H. These three species have been described in Nos. 30 and 42 of this Bulletin ; and *T. insignis* H. J. H. is identical with *T. cornuta* Illig, but the later name must be applied, as it has a priority of about four days.

It may be added that while *T. microphthalma* G. O. S. and *T. acutifrons* Holt and Tatt. are known only from the northern Atlantic, I have seen specimens at least both from the Atlantic and the Pacific of the nine other species.

Meganyctiphanes Holt and Tatt.

To the generic differences between this genus and *Nyctiphanes* G. O. S. pointed out by Holt and Tattersall may be added the excellent characters afforded by the copulatory organs. In *Meganyctiphanes* these organs are essentially as in *Thysanapoda* ; the inner lobe is short with its three processes well developed as in this genus, and the median lobe has not only a good-sized lateral process but besides additional processes (in a specimen investigated even four small additional processes). In *Nyctiphanes* the inner lobe is quite peculiar, being extremely produced in an oblong, more or less triangular, large plate with the outer margin sinuate and its major part serrate, while the spine-shaped process is developed as a curved, slender spine

and the terminal and proximal processes are quite wanting; furthermore the median lobe has a well developed lateral process and no additional process, but the lobe itself is

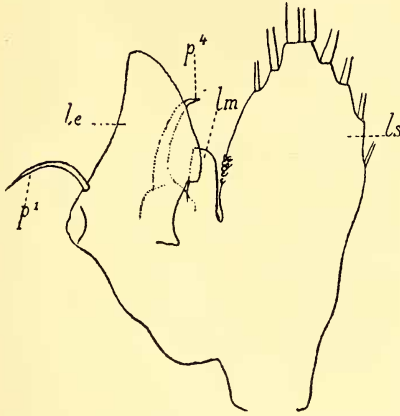


FIG. 3. *Nyctiphanes capensis* n. sp. Left copulatory organ, from behind. *li*. Inner lobe; *lm*. median lobe; *ls*. setiferous lobe; *p¹*. spine-shaped process; *p⁴*. lateral process.

short or very short, at most reaching the end of its process and sometimes terminating at the base of the process.

Only a single species, *M. norvegica* M. Sars, is known; Holt and Tattersall give a good representation (♂, Pl. xvi). Synonyms are: *Thysanopoda nana* M. Sars, *Euphausia intermedia* Riggio and *E. lanei* Holt and Tatt.

Nyctiphanes G. O. S.

The only reliable specific characters in this genus are afforded by the antennular peduncles of both sexes and the male copulatory organs. In the male the antennulæ have second and third joint conspicuously thicker than in the female, the adornment of both joints with processes or setæ differs in the two sexes, and the shape of third joint in the male is somewhat peculiar, while the shape of the upper distal leaflet from first joint is nearly identical in both sexes. But as Illig in 1908 (11) established a new

species, *N. latifrons*, on juvenile characters, among which a quite deviating shape of the frontal plate, it may be useful to give a brief account of very young specimens.

The Monaco collection contains a number of larval specimens and of older stages with the thoracic legs almost or fully developed, all belonging to *N. Couchi* Bell. In a specimen with only three pairs of thoracic legs fully developed the frontal plate is large, nearly quadrangular, with the front margin transverse and slightly emarginate, the carapace has a well developed denticle on its lateral margin near the posterior end, the upper lobe on first antennular joint is only a low protuberance, and the specimen is 4.5 mm. long. In a specimen, 5.8 mm. long, from the same locality the frontal plate is proportionately a little narrower in front, with the front margin itself feebly convex with the angles rounded, the lower lateral margin of the carapace has a low, protruding angle instead of the denticle, the last pair of legs are nearly fully developed, and the lobe on first antennular joint is more developed than in the preceding stage. In a specimen, 6 mm. long, from another locality the fifth pair of legs have scarcely arrived at full length, an angle on the lower margin of the carapace is indistinct, but the frontal plate agrees nearly with Illig's fig. c, as it is much produced with the front margin somewhat short but quite transverse, straight, not emarginate. According to these facts I am sure that *N. latifrons* Illig has been established on young specimens of *N. Couchi* Bell ; Illig's largest specimen measured 8 mm. in length, his specimens were taken off West Africa not far from Cape Blanco (I think at lat. 21° N.) and I have seen specimens of *N. Couchi* from the Atlantic coast of Morocco.

In young specimens measuring 6-7 mm. of *N. simplex* n. sp. from the East Pacific the frontal plate is shaped somewhat similar to that in the above-mentioned specimen of *N. Couchi*, but in the Pacific species the front margin is even distinctly emarginate, and each angle

produced into a small, acuminate process or slender tooth ; the lower margin of the carapace has an angle and in still smaller specimens a denticle as in the young of *N. Couchi*. I think that in young specimens of all species the frontal plate is shaped nearly as in *N. Couchi* or *N. simplex*, while it is triangular in subadult and adult specimens of all species of the genus.

Only 2 valid species have been established, viz. *N. Couchi* Bell and *N. australis* G. O. S. ; here 2 new species are added. The following diagnoses may be sufficient for the recognition of all 4 species. Adult males are generally larger than the females.

- a. *Lobe from first antennular joint somewhat small, broader than long, triangular, with the acute end situated above the inner margin of the antennula.*

Nyctiphanes Couchi Bell. — *Female* : Second antennular joint with a rather large, oblong plate anteriorly terminating in a spine, frequently digitate along its upper margin and situated at the upper inner edge of the joint near its end. *Male* : Second antennular joint with a low, oblong plate without processes placed at the upper inner edge of the joint a little from its end ; third joint with a close row of generally 3 (3-5) spiniform, strong, partly plumose setæ on the inner side of the joint near its base. Median lobe of the copulatory organs reaching rather near the end of the lateral process. — Length generally 14-17^{mm}.

Eastern part of North Atlantic.

N. capensis n. sp. — *Female* : Second antennular joint with the upper inner margin terminating in a minute or quite rudimentary spine, but without any protruding plate. *Male* : Second antennular joint without any plate at the end of the upper inner edge ; third joint with the close row of nearly spiniform setæ placed somewhat from the base or at the middle of the inner side of the joint. Median lobe of the copulatory organs reaching scarcely the middle

of the lateral process.—Length of the largest male 12.3^{mm}.

Off Cape St. Blaize, southern end of Africa. (Several specimens received from the Rev. T. R. R. Stebbing, who in his work on South African Crustacea recorded them as *N. australis* G. O. S.).

N. australis G. O. S. — *Female* : Second antennular joint with the upper inner edge terminating in a minute spine, but without any raised plate. *Male* : Second antennular joint with a low, raised plate projecting from the inner upper edge near the distal end ; third joint without any spiniform setæ, but with some quite minute hairs distributed along the inner side. Median lobe of the copulatory organs reaching fully the end of the lateral process. — Length of a female 13.5 mm., of a male 15 mm.

South-East Australia. (It may be added that according to my own observation two of the specimens mentioned by Ortmann in 1894 as *N. australis* belong to *N. simplex* n. sp., and I suppose that all his specimens from the localities enumerated by him belong to the last-named species.)

- b. *Lobe from first antennular joint large, conspicuously longer than broad, not triangular, with the short, acute tip turned mainly or totally outwards.*

N. simplex n. sp. — *Female* : Second antennular joint with the upper inner margin distally raised in an oblique spine or an obliquely triangular, acute tooth. *Male* : Second antennular joint at most with a small, raised, acute protuberance on the usual place ; third joint with the row of spiniform setæ situated as in *N. Couchi*. Median lobe of the copulatory organs abbreviated, having no part along the outer margin of the lateral process. — Length 11-16 mm.

Tropical and northern temperate East Pacific.

Rhoda Sim (**Boreophausia** G. O. S.).

This genus must be cancelled (see above), and its two species are referred to the genus *Thysanoëssa* Brandt.

Euphausia Dana.

In the « Siboga » report I enumerated or described 21 valid species of this genus; furthermore all synonyms or names to be cancelled were given. Here 6 new species are added, so that the genus now comprises 27 species. In spite of this great number adult males are always easy to determine, and in most cases adult females are far from difficult. The species may be referred to four groups, the first and the fourth of which are well separated from the others, while the second and the third, separated exclusively by the existence or non-existence of a dorsal process on third abdominal segment, are somewhat badly defined, because two species show individual or local variation as to the existence of this process. Nevertheless, I think it useful for practical reasons to establish the two last-named groups, as the exceptions are rarely met with and easily pointed out.

GROUP a. *Species with two pairs of lateral denticles on the carapace. No dorsal process on third to fifth abdominal segment.*

Five species are known, viz. *E. Krohnii* Brandt, *E. diomedæ* Ortm., *E. mutica* H. J. H., *E. recurva* H. J. H. and *E. brevis* H. J. H. *E. diomedæ* Ortm. and *E. mutica* H. J. H. have been described and figured in the « Siboga » report; of the three other species preliminary descriptions are found in No. 42 of this Bulletin (*E. Krohnii* Brandt is an older name for *E. Mülleri* Claus,

but not digged out in 1905). Two species are now added : *E. eximia* n. sp. and *E. americana* n. sp.

The two new species agree with *E. Krohnii* and differ sharply from the four other species of the group — and from every species of the genus — by having the conspicuous lobe of first antennular joint pectinate, with 5 to 10 very slender, spiniform denticles. The three species may be separated by the following diagnoses.

E. Krohnii Brandt. — The lobe from first antennular joint not only with the row of spiniform denticles along the margin, but its outer angle is produced into an oblique,

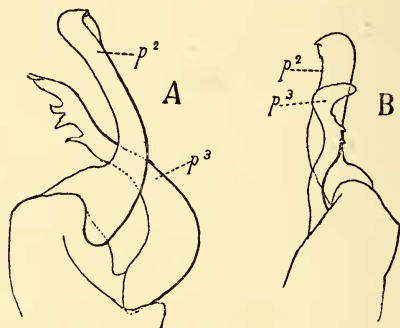


FIG. 4. *Euphausia Krohnii* Brandt. A. Inner lobe of left copulatory organ, from behind; p^2 . terminal process; p^3 . proximal process. B. Same lobe, from the inner side.

thin process with about three similar denticles. Second antennular joint above at each distal angle with an obliquely conical, conspicuous tubercle. The inner lobe of the copulatory organs (Fig. 4) has the terminal process moderately long and conspicuously widened towards the end which is broadly rounded with a minute lateral tooth; the proximal process with three irregular, large teeth or processes on the distal third of the inner margin, while the most terminal part is quite flattened and much bent in a direction vertical on that of the three teeth, and the end itself rounded. — Length 14-19 mm.

Atlantic, Mediterranean.

E. eximia n. sp. — The lobe from first antennular joint with 6-10 spiniform denticles along the margin, but without any ramified process from the outer angle. Second antennular joint above at the outer distal angle with a rather long, spiniform, acute process and a little behind the inner distal angle another spiniform or deeply bifurcate process. The copulatory organs (Fig. 5) have the terminal process long, its distal third gradually tapering to the acute

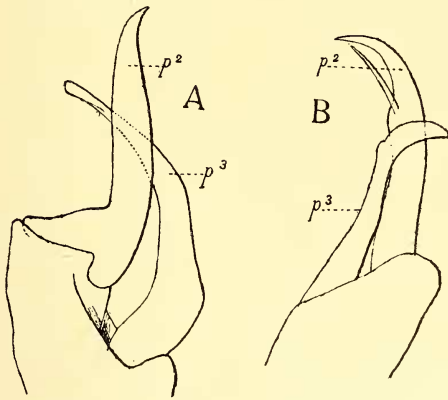


FIG. 5. *Euphausia eximia* n. sp. A. Inner lobe of left copulatory organ, from behind; p^2 . terminal process; p^3 . proximal process. B. Similar lobe, from the inner side.

end and evenly curved, while a thin spine originating from the base of this distal third projects to near its end; the proximal process has its distal third compressed, without teeth on the inner side, the terminal part much bent and with the end rounded as in *E. Krohnii*. — Length 16-20^{mm}.

Tropical East Pacific.

E. americana n. sp. — The lobe from first antennular joint with 5-6 denticles along the margin but without any ramified process from the outer angle. Second antennular joint above at the distal angles with the tubercles rudimentary or wanting. The copulatory organs (Fig. 6) have the terminal process short, thick, terminating in a strong trident

with its rami long and distally curved somewhat forwards, and with a thin spine originating at the base of the inner

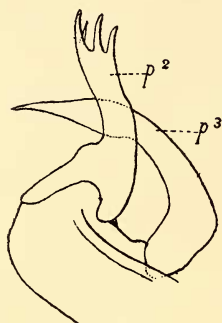


FIG. 6. *Euphausia americana* n. sp. Distal part of the inner lobe of left copulatory organ, from behind. p^2 . terminal process; p^3 . proximal process.

ramus; the proximal process conspicuously expanded beyond the middle on its inner side and here with some more or less distinct fine saw-teeth, while it distally tapers to the acute end. — The species is small, only 9-12 mm.

West Atlantic, Cap Verde.

GROUP b. *Species with a single (rarely no) pair of lateral denticles on the carapace. No dorsal process on third to fifth abdominal segment.*

Five species have been described : *E. superba* Dana, *E. tenera* H. J. H., *E. similis* G. O. S., *E. crystallorophias* Holt. and Tatt. and *E. lucens* H. J. H. Two new species are added here : *E. pacifica* n. sp. and *E. frigida* n. sp., and a variety of *E. Vallentini* Stebb. must be mentioned.

As to the antarctic species *E. superba* Dana and *E. crystallorophias* Holt. and Tatt. the reader is referred to Tattersall (17), while *E. tenera* H. J. H. (= *E. gracilis* G. O. S., not Dana) has been dealt with in the « Siboga » report. But the other species must be treated here.

E. similis G. O. S. — This species has been described by Sars (16); in the « Siboga » report a few corrections were stated together with a special description of the antennulæ which afford excellent characters; furthermore the anomalous vaulting and shape of the gastric area and

frontal plate with rostrum in a couple of specimens (var. *crassirostris* H. J. H.) was described. In Sars' type, in all specimens from the Swedish Antarctic Expedition, from the northern part of the Indian Ocean, from the «Siboga» and from Japan (U. S. Nat. Mus.) the third abdominal segment has no free dorsal process, but first to third abdominal segments each dorsally at the middle of the hind margin with a small, produced and rounded part, while the hind margin of the two next segments is straight. But the Copenhagen Museum possesses 11 specimens taken at two localities far South (lat. $40^{\circ}9'$ S. and $37\frac{1}{2}^{\circ}$ S.) and very distant from each other in South Atlantic, from a locality at lat. 13° S., long. $103\frac{1}{3}^{\circ}$ E., and from a locality between New Zealand and Tasmania, and all these specimens, most of them adult but differing much in size, agree with the typical form in the eyes and the rostrum, in the structure of the antennulæ and the produced rounded part of the hind margin of first and second abdominal segment — this feature being an excellent specific character — but their third abdominal segment is carinated posteriorly in

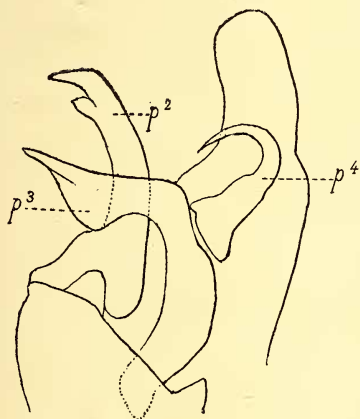


FIG. 7. *Euphausia similis* G. O. S., var. *armata* n. var. Inner and median lobe of left copulatory organ, from behind. *p*². terminal process; *p*³. proximal process; *p*⁴. lateral process.

the median line and produced into a compressed, somewhat short, but very conspicuous, acute process. That the specimens with this process are only a variety, not a separate species, is proved by the agreement in the other characters enumerated and by the copulatory organs (Fig. 7)

which are nearly alike in specimens with or without dorsal process and rather different from those in any other species. The terminal process of these organs has a sharp protuberance at some distance from the end, and the most terminal, short part is bent considerably or strongly inwards and acute. The proximal process is interesting; its distal third is bent abruptly and strongly inwards and widens extremely on the inner, proximal side of this part, while the most terminal part is strongly compressed, forming a lamella directed backwards and vertical on the broad expansion mentioned; seen from behind the whole process forms a kind of hatchet with the handle straight or a little to somewhat curved and the blade increasing extremely in breadth towards the edge, the distal part of which is bent outwards, being vertical on the other part of the blade. — For the variety with a protruding, acute process on third abdominal segment I propose the name *armata* n. var.

E. lucens H. J. H., *E. frigida* n. sp. and *E. pacifica* n. sp. are closely allied and similar in general aspect. The eyes are large, the rostrum is either a small triangle considerably shorter than broad or rudimentary; the lobe of first antennular joint is a somewhat small, subacute or acute triangular process or, in *E. frigida*, quite rudimentary; the dorsal part of the hind margin of the abdominal segments is transverse, straight; etc. They may be distinguished from each other by the following diagnoses.

E. lucens H. J. H. — Rostrum generally a distinct, low triangle considerably broader than long, rarely nearly rudimentary. Lobe from first antennular joint conspicuous, triangular, about as broad as long, subacute or acute, but not acuminate, protruding forwards and upwards; second antennular joint robust, somewhat short and not longer than the third. Terminal process of the copulatory organs long (Fig. 8), reaching somewhat beyond the median lobe, slender, conspicuously expanded towards the bifurcate end, the inner ramus of which is very much

broader and much longer than the outer. The proximal process shorter than the terminal, with a slender and proportionately somewhat long secondary branch in front beyond the middle, while the distal part in extremely expanded, forming a very oblique plate broader than long,

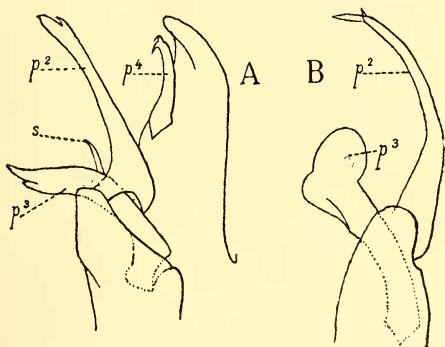


FIG. 8. *Euphausia lucens* H. J. H. A. Inner and median lobe of left copulatory organ, from behind. p^2 . terminal process ; p^3 . proximal process, with its secondary branch, s ; p^1 . lateral process. B. Inner lobe, from the inner side.

with the terminal margin a little emarginate considerably from the middle and with the two parts of the plate very different in size. Lateral process with an oblong, curved, acute tooth a little before the end.

The Copenhagen Museum possesses a number of specimens from three localities in the South-East Atlantic, between lat. 35° and 38° S., long. 2° W. and $20\frac{1}{4}^{\circ}$ E., and from a locality between Tasmania and New Zealand. Sars' types were taken off Cape of Good Hope — on the structure of their antennular lobes see Tattersall (17, p. 14) — while the three other localities given by Sars ought for different reasons to be cancelled at least until further evidence is to hand.

E. frigida n. sp. — Rostrum a low triangle as in *E. lucens*. Lobe from first antennular joint quite rudimentary, at most an extremely minute triangle perceived when inspected from in front with the next joint bent down-

wards; second joint slightly longer than, and scarcely as robust as, in *E. lucens*, but not longer than the third. Copulatory organs (Fig. 9) with the terminal process only moderately long, rather far from reaching the end of the median lobe, slightly thicker at the end, which is bifurcate with

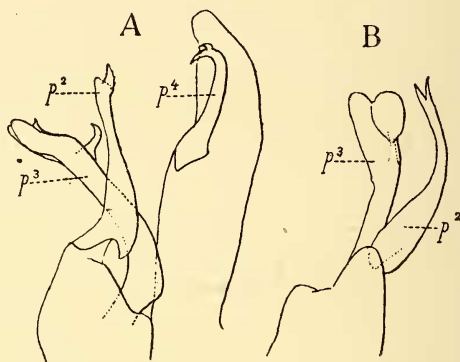


FIG. 9. *Euphausia frigida* n. sp. A. Inner and median lobe of left copulatory organ, from behind. p^2 , terminal process; p^3 , proximal process; p^4 , lateral process. B. Inner lobe, seen from the inner side.

the inner ramus shorter, or at most as long as, and scarcely thicker than, the outer. Proximal process conspicuously longer than the terminal, with a slender and somewhat long secondary branch in front at the end of the second third; the distal part much expanded, forming a plate which is about as long as broad, not oblique and with the terminal margin deeply emarginate near the middle. Lateral process with a tooth a little from the end as in *E. lucens*. — Length of the largest specimen 20.5 mm.

The Swedish Antarctic Expedition has captured a good number of this species at four stations in the area between lat. 49° and $53^\circ 10'$ S., long. $48 \frac{1}{3}^\circ$ and $36 \frac{1}{3}^\circ$ W. Tattersall has mentioned (17, p. 14-16) a number of specimens from lat. $57^\circ 25 \frac{1}{2}'$ S., long. $151^\circ 43'$ E.

E. pacifica n. sp. — A rostral process is not developed, the front margin of the carapace being only feebly produced, forming a very obtuse angle at the middle with the

tip scarcely acute. Lobe from first antennular joint is a small, oblong-triangular, acuminate and very acute process; second and third antennular joints more slender and a little longer than in *E. lucens*; second joint distinctly longer than the third. Terminal process of the copulatory organs (Fig. 10) moderately short, a little thicker than in two other species, a little expanded towards the end, with the outer ramus only a short tooth and the inner very much

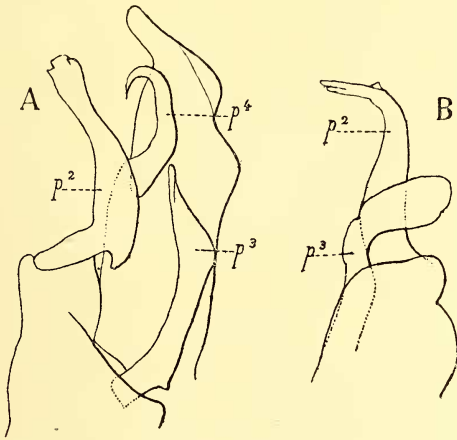


FIG. 10. *Euphausia pacifica* n. sp. A. Inner and median lobe of left copulatory organ, from behind. p^2 . terminal process; p^3 . proximal process; p^4 . lateral process. B. Inner lobe, from the inner side.

longer but bent much forwards. The proximal process somewhat longer than the terminal, without any secondary branch beyond the middle, while the distal part is somewhat expanded, forming a plate which is much longer than broad, with the terminal margin rounded and only very feebly emarginate somewhat from the broadly rounded end. Lateral process without tooth on the distal part. — Length of one of the largest specimens 22^{mm}.

This species is distributed in the temperate and boreal North Pacific; it is very common at Japan. The specimens referred in 1894 by Ortmann to *E. splendens* Dana belong certainly to *E. pacifica*.

E. Vallentini Stebb. — This species belongs to the next group, as it generally possesses a somewhat short and very thin dorsal process on third abdominal segment. But in some specimens studied by Tattersall (17, p. 13) and in at least one of the numerous specimens seen by me this dorsal process was wanting and did not seem to have existed, to have been broken off. Such specimens bear some resemblance to *E. lucens*, but are readily distinguished especially by the shape of the rostrum and the lobe from first antennular joint. The rostrum is a somewhat small triangle about as long as broad, thus conspicuously narrower, longer and better defined than in *E. lucens*. The lobe of first antennular joint is very conspicuous, not triangular, but an anteriorly rather broadly rounded plate more horizontally projecting than the triangular process in *E. lucens*; finally the eyes are proportionately somewhat larger in *E. lucens* than in *E. Vallentini*. The copulatory organs almost as in *E. lucens*, but the proximal process a little longer than the terminal (Tattersall, 17, Pl. IV, Fig. 10) and the latter with its distal part somewhat aberrant from that in *E. lucens*.

The Swedish Antarctic Expedition captured a large number at several stations in an area East of the southern part of South America to South Georgia, and a single specimen so far northwards as lat. $32\frac{1}{4}^{\circ}$ S., long $50^{\circ}14'$ W. It was known from the Falkland Islands, between New Zealand and Chili, and at lat. $56^{\circ}54'$ S., long. $170^{\circ}28'$ E.

GROUP c. *Species with a single pair of lateral denticles on the carapace. A protruding, acute dorsal process on third abdominal segment, but without any dorsal process — at most with a minute denticle (E. mucronata) — on fourth and fifth abdominal segment.*

This group comprises 8 species already established : *E. Vallentini* Stebb., *E. gibba* G.O.S., *E. paragibba* H.J.H., *E. hemigibba* H. J. H., *E. pseudogibba* Ortm., *E. Sibogæ* H.J.H., *E. gibboides* Ortm. and *E. mucronata* G.O.S.;

E. similis G. O. S. var. *armata* n. var. ought to be named here, and 2 new species are added: *E. distinguenda* n. sp. and *E. lamelligera* n. sp.

The «Siboga» report contains a detailed account of *E. paragibba* H. J. H., *E. hemigibba* H. J. H., *E. pseudogibba* Ortm. and *E. Sibogæ* H. J. H.; *E. Vallentini* Stebb. and *E. similis* G. O. S. var. *armata* are dealt with in the preceding group; the five remaining species must be mentioned or described.

E. gibba G. O. S. — This species which has been on the whole well described by Sars, is closely similar to *E. paragibba* H. J. H. The female of *E. gibba* differs from that of *E. paragibba* by having the keel on third antennular joint a little higher and less rounded, by being smaller, and, judging from the colour of specimens preserved in alcohol, by the colour in living specimens. But the male copulatory organs (Fig. 11) differ strongly in several features from those in all other species of the genus. The terminal process is unusually small, subconical, thick at the base and with the distal part slender, acute and suddenly bent forwards and outwards; the heel in very slender. The proximal process is extremely long and very strong, thickened at the base and then tapering to the acute end; somewhat before the middle it is bent conspicuously inwards, and somewhat beyond the middle more outwards and besides forwards, its distal third being almost straight. The lateral process without any tooth beyond the middle. From the outer angle of the distal rounded, rather broad end of the median lobe originates a curious, very slender,

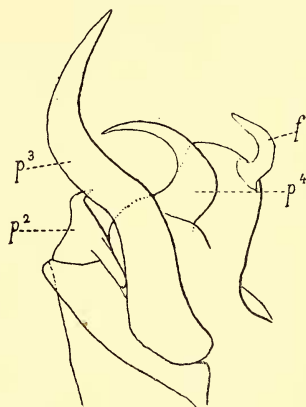


FIG. 11. *Euphausia gibba* G. O. S. Inner and median lobe of left copulatory organ, from behind. p^2 . terminal process; p^3 . proximal process; p^4 . lateral process; f . thin-skinned finger from the end of the median lobe.

thin-skinned finger distally curved inwards. — Length 11-15 mm.

Tropical and subtropical Pacific South of the line.

E. distinguenda n. sp. — The body is slender, the eyes rather small, and the species is on the whole somewhat similar to *E. pseudogibba*, *E. paragibba*, etc., but is distinguished by several characters, among which some are of special importance. The first antennular joint is distally somewhat raised with the terminal upper margin a little convex, but without any protruding lobe or process; the second joint has the distal upper and outer angle raised as a rather short, oblique keel forming a nearly ear-like, rounded process directed upwards and somewhat forwards; third joint, seen from the side, with the dorsal keel high, but occupying only the distal half of the upper margin. The copulatory organs with their processes shaped in the main as in *E. Siboga* (6, Pl. xiv, Fig. 7^d), thus very different from those in *E. pseudogibba*, etc. Furthermore the frontal plate is moderately short with a small or nearly rudimentary, badly defined, acute rostrum. The dorsal process on third abdominal segment compressed, spiniform, one-third to nearly half as long as the next segment. — Length 10-14.5 mm.

Tropical East Pacific, where it is common (Agassiz Exp.).

E. lamelligera n. sp. — The frontal plate is very short, laterally somewhat produced with right angles, while the long front margin is almost transverse, being only feebly produced at the middle with an extremely obtuse angle. Eyes large. Lobe from first antennular joint moderately short, directed upwards, forwards and somewhat outwards, and with the end more or less distinctly cleft. Second antennular joint at the upper outer distal angle with a very large, movable, curved lamella covering nearly half of the upper surface of the third joint and a good portion of its outer surface; third joint, seen from the outer side, with the dorsal keel high and occupying

the distal half of the margin. The dorsal process on third abdominal segment slender, spiniform, compressed, about one-third as long as the next segment. Copulatory organs somewhat reminding of those in *E. Sibogæ*, but differing in some features; the terminal process has the keel shorter and more curved, the main part longer and more slender; the proximal process has the end rounded; the lateral process distally with a tooth as in *E. Sibogæ* and *E. distinguenda*. — Length 7.5-10.8^{mm}.

The tropical East Pacific, where it is rather common (Agassiz Exp.).

The species is easily separated from all other forms by the curious, large and movable lamella from second antennular joint.

E. gibboides Ortm. — The rostrum is rather long with its distal part spiniform; the eyes large. First antennular joint distally considerably raised above with a moderately long lobe directed forwards and somewhat upwards and beyond the middle abruptly bent much outwards, its terminal part being an oblong, acute triangle. Second joint distally with the upper wall produced as a kind of short lobe covering the basal part of third joint excepting near the outer margin, and the anterior margin of this lobe is distinctly concave and its outer angle right. Third joint with a high and long dorsal keel; the terminal margin of this keel is very oblique and incised above, while the upper angle is produced in a spine. Third abdominal segment with the dorsal process short. The copulatory organs differ in several features from those in the preceding species, but special mention is scarcely needed, as the characters enumerated may be sufficient. — Length of a large male 22^{mm}, of a very large female 27^{mm}.

Temperate and tropical North Atlantic and tropical East Pacific.

E. mucronata G. O. S. — The very short frontal plate produced in a very short, proportionately very broad and badly defined rostrum terminating in an obtuse angle.

First antennular joint produced in a rather short, deeply bifid lobe, with its two acute teeth directed upwards and more outwards than forwards. Second joint with the

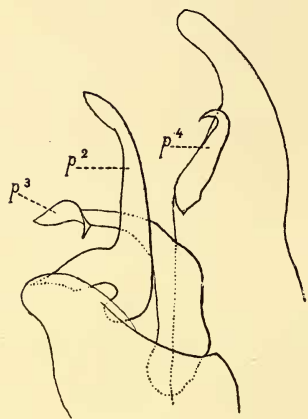


FIG. 12. *Euphausia mucronata* G. O. S. Inner and median lobe of left copulatory organ, from behind. p^2 . terminal process; p^3 . proximal process; p^4 . lateral process.

upper terminal margin at the outer side produced in a small angle or tooth; third joint, seen from the outer side, with the dorsal keel somewhat more than half as long as the joint, moderately high, terminating in a minute, acute denticle. Third abdominal segment has a dorsal, strong, compressed process with the upper margin somewhat convex and the lower straight. The copulatory organs (Fig. 12) show several peculiarities; the terminal process has its most distal part flattened, somewhat expanded and curved inwards; the proximal process is nearly semicircularly curved,

with its most distal part directed inwards and much expanded, forming a curiously bent plate with a conspicuous, slender tooth at the base; the lateral process — as in *E. gibboides* — without tooth, and a minute, spini-form additional process is present. — Length 18-22^{mm}.

East Pacific.

It may be mentioned that Sars' figures and description differ in several particulars from his type which agrees with my specimens.

GROUP d. *Species with a single pair of lateral denticles on the carapace. A well developed dorsal process on third abdominal segment and conspicuous dorsal denticles or processes on fourth and fifth segments.*

This group comprises 3 large and robust species with the rostrum rather long to very long, viz. *E. triacantha* Holt and Tatt., *E. spinifera* G. O. S. and *E. longirostris* H. J. H. The following key may be sufficient for the determination ; the three species have been described and figured respectively in the « Challenger » report and in the two papers by Tattersall and myself referred to below.

a. Posterior margin of third to fifth abdominal segment normal, without incisions and lamellar, triangular protuberances. Lateral denticles of the carapace situated at the lower margin (Lobe of first antennular joint bifid). *E. triacantha* Holt and Tatt.

b. Posterior margin of third to fifth abdominal segment with incisions and lamellar protuberances. Lateral processes of the carapace situated above the lower margin.

α. Lobe from first antennular joint broad, with the margin irregularly incised and digitate.

E. spinifera G. O. S.

β. Lobe from first antennular joint high, distally rather narrow with the end bifid. *E. longirostris* H. J. H.

E. triacantha is known from the Antarctic South-East of New Zealand (Tattersall 17), *E. longirostris* from the Antarctic South of the Falkland Islands (H. J. Hansen, 5) and both have been taken by the Swedish Antarctic Expedition in the area at South Georgia. The Copenhagen Museum possesses specimens of *E. spinifera* from eleven localities situated in a nearly transverse belt between lat. $32\frac{1}{2}^{\circ}$ and 38° S. in the Atlantic and between lat. 38° S. and $40^{\circ}50'$ S. in the Indian Ocean and the West Pacific, and Sars had it from South of Australia and about midway

between New Zealand and Chili ; the species in thus distributed around the globe in a proportionately narrow belt North of the Antarctic.

Pseudeuphausia H. J. H.

Only one species, *P. latifrons* G. O. S., is known. The genus was established and the species redescribed in the « Siboga » report. It is known from the Southern end of Africa (Stebbing) through the Indian Ocean to the tropical East Pacific and off South-East Australia.

Thysanoëssa Brandt.

This genus is rather difficult and imperfectly known. As shown above, the genus *Rhoda* cannot be maintained as different from *Thysanoëssa*, and as the two features, viz. constricted eyes and first pair of thoracic legs elongate and thickened, hitherto considered the main characters of *Thysanoëssa* show exceptions, it is necessary to give a new diagnosis of the genus.

DESCRIPTION. — Rostrum always good-sized, rather long to very long. Eyes sometimes almost completely circular, generally distinctly or considerably higher than broad, narrowing upwards and most frequently above the middle divided by a transverse constriction. Antennulæ with the peduncles showing sexual differences and their two distal joints slender in the female ; upper flagellum at most somewhat longer than the peduncles, frequently much shorter. Five anterior pairs of thoracic legs with full number of joints ; first pair frequently elongate and thickened, but with setæ or spines along the whole margin of sixth and seventh joint ; sixth pair with the exopod normally developed, the endopod wanting in the males, in adult females always present, articulated to the broad,

exopod-bearing joint, unjointed or two-jointed and from more than half as long as to somewhat longer than the exopod; seventh pair without endopod, while the exopod is somewhat styliform, naked or with setæ at the end. Copulatory organs with the spine-shaped process thin and curved as in *Thysanopoda*, the two other processes of the inner lobe and the lateral process well developed but no additional process. The other characters as in *Nematoscelis*.

REMARKS. — This genus agrees with *Nematoscelis* and *Stylocheiron* and differs from *Thysanopoda*, *Euphausia*, *Pseudeuphausia* and *Nematobranchion* by the antennular peduncles in both sexes; in the female the two distal joints are slender, the third thinner and generally longer than the second and both without lobes or keels; in the male these two joints show always sexual characters and most frequently especially the third joint is shorter and thicker than in the female, but sometimes second joint is more altered. The sexual difference in the development of sixth pair of legs is very interesting, but the same difference is found in *Nematoscelis* and *Stylocheiron*. The genus is closely allied to *Nematoscelis*, especially to its group A (see below), the main difference being the structure of the first pair of legs; some difference is also found in the copulatory organs, and the females of *Thysanoëssa* do not carry their eggs.

The geographical distribution of this genus is interesting. While every other genus of the order comprising more than a single species has its richest development in the tropical, or (*Nyctiphanes*) the temperate, areas of the oceans and has no or at most (*Euphausia*) relatively few representatives in cold seas, the large genus *Thysanoëssa* is essentially found in cold water, living in the Arctic and Antarctic and the colder adjacent transverse belts of the Atlantic and the Pacific, while not a single specimen of the genus has been found in the tropical belt around the globe.

The following key gives a view of the 8 species hitherto

established together with 1 new, hitherto misinterpreted, antarctic species.

A. Third or fourth abdominal segment with a good-sized, compressed dorsal process from the hind margin.

a. Third abdominal segment with a good-sized process from the end of its strong dorsal keel, and small dorsal processes or denticles on the three following segments. Eyes considerably higher than broad, with transverse constriction. Lateral margins of the carapace with a denticle at the middle. First pair of legs elongate and robust. *T. longipes* Brandt.

b. Third abdominal segment without any process from its strong dorsal keel, but a good-sized process on the fourth segment and distinctly smaller processes on the two following segments. Eyes a little higher than broad, without constriction. Lateral margins of the carapace without denticle. First pairs of legs slightly or at most a little longer and somewhat stronger than the second. *T. spinifera* Holmes.

B. Third and fourth abdominal segments without dorsal processes.

a. Lateral margins of the carapace without any denticle.

α. Sixth abdominal segment much shorter than the sum of the two preceding segments, with a strong spine from its upper distal end. Rather large and somewhat robust species. *T. inermis* Kr.

β. Sixth abdominal segment elongate, almost or fully as long as the sum of the two preceding segments, and without any spine from its upper distal end. Slender and rather small species.

T. longicaudata Kr.

b. Lateral margins of the carapace with a denticle. (No spine from the upper end of sixth abdominal segment.)

α. Denticle before the middle of the lateral margin of the carapace. Eyes nearly circular, without constriction. First pair of legs not elongate, shaped as the second. *T. Raschii* M. Sars.

β. Denticle conspicuously behind the middle of the lateral margin. Eyes conspicuously higher than broad, with constriction. First pair of legs elongate, differing from the second.

ξ. Sixth abdominal segment somewhat and generally considerably shorter than the sum of the two preceding segments.

†. Setæ along the lower margin of fifth and sixth joint of second to fourth pair of legs thin, not ciliated, much shorter than some of the terminal seta of seventh joint. Terminal process of the copulatory organs not widened towards the truncate end ; proximal process with about the same breadth from the middle to the obliquely truncate end, and the terminal very short part bent somewhat outwards, obliquely truncate with the inner front angle produced into a tooth. *T. parva* H. J. H.

††. Setæ along the lower margin of fifth and sixth joint of second to fourth pair of legs strong, conspicuously ciliated, as long as, or longer than, the terminal setæ of seventh joint. Terminal process of the copulatory organs somewhat expanded towards the terminal margin, which is feebly convex and finely serrate along the front side, while the inner distal angle is obtuse but scarcely rounded, the outer acute and produced ; proximal process with a large, triangular, wing-like expansion serrate along the distal margin and occupying the major part of the distal half of the outer margin, while the part beyond this expansion is short, slender, somewhat curved, subacute and with teeth on the outer margin.

T. gregaria G. O. S.

ξξ. Sixth abdominal segment almost or fully as long as the sum of the two preceding segments.

†. Antennulæ with the upper flagellum somewhat or considerably longer than the sum of the two distal peduncular joints. Terminal process of the copulatory organs a little expanded on the inner side towards the terminal margin which is convex with fine saw-teeth along the front side; proximal process with the end somewhat expanded and curved backwards, with the terminal margin transverse and serrate (seen from the side this terminal part is quite thin and somewhat curved). Rather small species. *T. vicina* n. sp.

††. Antennulæ with the the upper flagellum somewhat shorter than the sum of the two distal peduncular joints. Terminal process of the copulatory organs distally expanded at both sides and especially outwards, with the terminal margin long, oblique, conspicuously emarginate, without serration, while the terminal inner part is a projecting, broadly rounded lobe, the terminal outer part subtriangular with the free angle narrowly rounded; proximal process with a very short terminal part strongly curved, slender at the base of the curvature and the end itself distinctly broader with the margin transverse. Species of considerable size. *T. macrura* G. O. S.

Some remarks on the species may be added as supplement to the characters to be derived from the key.

T. longipes Brandt. — Rostrum rather narrow, acuminate, slightly more slender in the male than in the female. Antennulæ with the two distal peduncular joints in the female long and slender, and the third joint scarcely or slightly longer than the second; in the male both joints are thicker and considerably shorter, but without processes or setiferous lobes. Copulatory organs with all four

processes unusually long and slender, without any expanded part. — Length of the largest female 30 mm., of a male 24 mm.

Bering Sea and North-West Pacific.

T. spinifera Holmes. — Holmes has published (7) a good description with figure of his single specimen of this fine species. In the female the two distal peduncular joints are much shorter than in the female of *T. longipes*, and the third joint is somewhat shorter than the second; in the male these two joints are at least as long as, and slightly thicker than, in the female, and a large upper part of the wall at the end of the inner side of second joint is produced upwards and forwards as an oblique plate, the terminal margin of which is rounded, very oblique and furnished with a very close row of fine, rather long and distally curved setæ directed upwards and forwards. The copulatory organs with the processes considerably shorter than in *T. longipes*, somewhat similar in outline to those of *T. inermis*. — Length of large female 26 mm., of a male 20 mm.

California, Alaska.

T. inermis Kr. (*Rhoda* or *Boreophausia inermis* Kr., *Thysanoëssa neglecta* Kr., *T. borealis* G. O. S). — It is scarcely necessary to add anything to the detailed account in the second chapter of this well-known species.

T. longicaudata Kr. (= *T. tenera* G. O. S.). — This small, slender species differs from *T. parva* and *T. gregaria* by having the sixth abdominal segment somewhat longer in proportion to the combined length of the two preceding segments than in the two other species. In cases of doubt the absence of a minute denticle on the lateral margins of the carapace behind the middle is a deciding character. Good figures of the female are given by Holt and Tattersall (8); in this sex the third peduncular joint of the antennulæ is a little longer and conspicuously thinner than the second, while in the male second joint is slightly shorter and thicker, third conspicuously shorter and thicker than

in the female, but third joint not shorter than the second. The copulatory organs (Fig. 13) are characteristic. The spine-shaped process is longer than usual, at least more than half as long as the two other processes; the terminal process has a thin keel on the postero-exterior side reaching

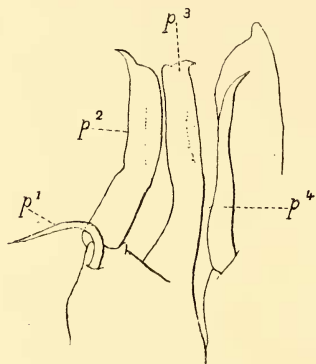


FIG. 13. *Thysanoëssa longicaudata* Kr. Inner and median lobe of left copulatory organ from behind. *p*¹. spine-shaped process; *p*². terminal process; *p*³. proximal process; *p*⁴. lateral process.

from before the middle to rather near the end, and the short terminal part of the process is slender, curved essentially forwards and acute; the proximal process has the same not inconsiderable breadth from the middle to the end, but this breadth is partly due to a thin keel; the end varies in shape, having the outer angle rounded or produced in a tooth.

Northern half of the temperate and boreal Atlantic, and the Arctic Ocean from the Baffin Bay to lat. 124° E.

T. Raschii M. Sars. — To the characters in the key of this tolerably well-known species — hitherto referred to *Rhoda* or *Boreophausia* — may be added, that in the male the rostrum is much broader than in the female, forming a long and oblong, flat plate; the second antennular joint is in the male somewhat thickened with the upper terminal margin produced in a conspicuous, setiferous lobe protruding above the base of the next joint, while the third joint is in both sexes a little longer than the second, in the female slender and cylindrical, in the male somewhat thickened at the end. The copulatory organs in general aspect rather similar to those of *T. iner-*

mis, but the distal part of the terminal process is far less tubiform.

The species has about the same distribution as *T. inermis*, thus also found in the Bering Sea and the boreal Pacific.

T. parva H. J. H. — Antennular peduncles in the female with the third joint slightly or a little longer and somewhat thinner than the second, in the male as long as or slightly longer and a little thinner than the second, but both joints slightly thicker than in the female ; the upper flagellum about as long as the sum of second and third peduncular joint. The copulatory organs (Fig. 14) with the spine-shaped process normal, small ; the terminal

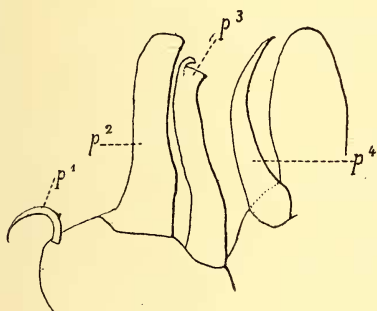


FIG. 14. *Thysanoëssa parva* H.J.H. Inner and median lobe of left copulatory organ, from behind. p^1 . spine-shaped process; p^2 . terminal process; p^3 . proximal process; p^4 . lateral process.

processes with the same breadth from the middle to the truncate, feebly convex, scarcely serrate end ; the proximal process moderately broad from the middle to the end, with a short terminal part turned somewhat outwards and obliquely truncate, but the inner front angle produced into a small tooth, the distal part of this process in reality showing a strong reduction of the features found in *T. gregaria*. As to other particulars I refer to Nos. 30 and 42 of this Bulletin.

Temperate North Atlantic.

T. gregaria G. O. S. — The antennular peduncles nearly as in *T. parva*, but the upper flagellum conspicuously shorter than the sum of the two distal peduncular joints. Sars has given a good description with figures ; the

structure of the copulatory organs, especially the shape of the proximal process (16, Pl. xxii, Fig. 29) affords the most excellent character. The species varies much in length and in the shape of the long rostrum, and conspicuously in length and relative depth of the sixth abdominal segment. Some few among the adult males captured by the Swedish Antarctic Expedition are small with sixth abdominal segment slender and not much shorter than the sum of fourth and fifth, thus in this feature differing but little from small specimens of the two antarctic species, but they are instantly separated by the peculiar copulatory



FIG. 15. *Thysanoëssa gregaria* G. O. S.
Inner lobe of left
copulatory organ,
from behind.

organs (Fig. 15); some other males from the same area are good-sized with sixth abdominal segment deeper and proportionately a little shorter. — Length of adult specimens 8.5-16.5 mm.

The geographical distribution is interesting. The species is known from the temperate North Atlantic, the temperate South Atlantic and southwards in the antarctic area to about lat. $53\frac{1}{2}^{\circ}$ S. (Swedish Antarctic Exp.), furthermore from lat. $39^{\circ}56'$ S., long 40° E. (Copenhagen Museum), South Pacific (Sars), temperate North Pacific (Sars, Holmes), and northwards at least to Bering Island (U. S. Nat. Museum) — but it has never been taken in the tropical area and, so far as I can see, perhaps not in the subtropical belts of any ocean.

T. vicina n. sp. — The essential characters have been pointed out in the key (Fig. 16). The species has been mixed up with *T. macrura*, but it is considerably smaller,

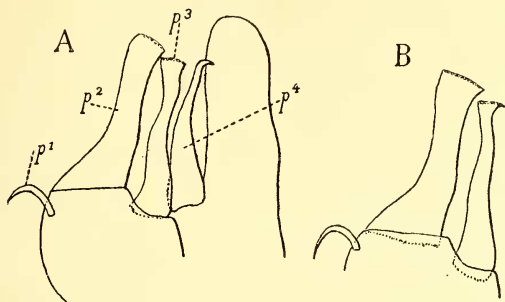


FIG. 16. *Thysanoëssa vicina* n. sp. A. Inner and median lobe of left copulatory organ of a specimen from the Swedish Antarctic Expedition. p^1 . spine-shaped process; p^2 . terminal process; p^3 . proximal process; p^4 . lateral process. B. End of inner lobe with its three processes of an organ from a specimen taken by the « Discovery » (see the text).

measuring at most 17 mm., and frequently about 12-13 mm. — I have seen a large number from the antarctic area explored by Dr. O. Nordenskjöld and from lat. $61^{\circ} 13 \frac{1}{2}'$ S., long. $173^{\circ} 33'$ E. « Discovery ».

T. macrura G. O. S. — As to the essential characters see the key and Fig. 17. The specimens to hand, however, show various interesting features and differences arising from age and individual variation, but an account must be postponed to the report on the Swedish Antarctic Expedition. — The largest female seen by me is 28.5 mm., the adult males to hand are much smaller, only about 18-19 mm.

Of this antarctic species a moderate number was taken by the Swedish Expedition. Sars' type is from « Antarctic Ocean, near ice-barrier, Febr. 14, 1874 »; it may be added that I have separated *T. vicina* from *T. macrura* some years after I had looked through the « Challenger » material in the British Museum, but Sars' figures of his evidently quite young specimens agrees on the whole better with

T. macrura as interpreted by me than with *T. vicina*, and the latter species is more fragile than *T. macrura* and most or all thoracic legs are most frequently lost. The statements of localities for *T. macrura* in the literature

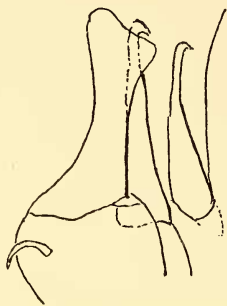


FIG. 17. *Thysanoëssa macrura* G. O. S.
Inner and median
lobe of left copu-
latory organ, from
behind.

from the «Challenger» to 1910 are unreliable, because it is impossible to decide whether the specimens seen belong to *T. vicina* or to *T. macrura*; the only exceptions are a few of the «Discovery» localities enumerated by Tattersall (17), as it is certain that his specimen measuring 28 mm. from lat $72^{\circ} 29' 27''$ S., long. $168^{\circ} 51' 46''$ E. belongs to *T. macrura*, that his specimens seen by me from lat. $61^{\circ} 13' 1/2'$ S., long. $173^{\circ} 33'$ E. are *T. vicina*, while in all probability at least some of his specimens from the winter-quarters of the «Discovery» and from his two first stations from the journey belong to *T. macrura*; besides his Fig. 11 on Pl. III represents the copulatory organ of *T. macrura*.

Tessarabrachion n. gen.

Rostrum is a small, very short triangle much broader than long and badly defined. First and second pairs of legs very elongate, completely similar and showing in the main the same shape and furniture as first pair in a long-legged *Thysanoëssa*. The remaining legs and all other characters as in *Thysanoëssa*.

This new genus which is established on a single new species, it not very valuable, but the fact that two pairs of legs are elongate and developed as prehensile organs is so interesting and so different from the structure of the other genera, that the establishment of a genus is deemed nearly necessary.

T. oculata n. sp. — The upper front part of the carapace shaped almost as in *Nematobranchion boopis* Calm., being produced at the middle in a small and very short triangle much broader than long and without any terminal process, while the whole upper and the upper lateral part of the front margin of the carapace is bent upwards. No denticle on the lateral margins of the carapace. Eyes very large, considerably higher than broad, divided by a feeble constriction somewhat above the middle, but the upper section nearly as broad as the lower. Antennulæ with the two distal peduncular joints long and slender in the female, conspicuously shorter and thicker in the subadult male (the adult male is unknown); upper flagellum a little shorter than the lower and shorter than the sum of the two distal peduncular joints. First pair of legs with the fourth joint reaching the end or conspicuously beyond the end of the antennular peduncles. Abdominal segments without dorsal denticles or keels; sixth segment about as long as the sum of the fourth and the fifth. — Length of the largest female 24 mm.

Boreal North Pacific (U. S. Nat. Museum).

Nematoscelis G. O. S.

To Sars' description of the genus some points may be added. In the female second and third antennular joints are slender and rather long; in adult males they are conspicuously or even much thicker, second joint somewhat and third considerably shorter than in the other sex. Sixth pair of legs with the exopod well developed in both

sexes, the endopod two-jointed and longer than the exopod in the female, wanting in the male. The copulatory organs possess the three processes on the inner lobe, but the spine-shaped process is nearly straight and nearly parallel with the two others which are inserted on the end of the lobe; the lateral process is never hook-shaped and an additional process wanting.

The 6 species of the genus may be divided into two groups separated by some sharp characters.

- A. Maxillulæ with a pseudexopod well developed. First elongate pair of legs with long spines both from the terminal joint and from the distal angle of the penultimate joint. Second to fifth pair of legs with the full number of joints, therefore three joints beyond the knee.
- B. Maxillulæ without pseudexopod. First pair of legs with long spines only from the terminal joint. Second and third pairs of legs with but two joints beyond the knee, fourth and fifth pairs with one joint beyond the knee.

GROUP A.

This group comprises *N. megalops* G. O. S. and *N. difficilis* n. sp. *N. megalops* is known only from the Atlantic.

N. difficilis n. sp. — At least by a preliminary examination I have not found any other reliable character between this Pacific form and the Atlantic *N. megalops* than differences in the terminal and proximal processes of the male copulatory organs. But as the two processes afford excellent characters in the other species of the genus, I was forced to establish *N. difficilis* as a new species. And three adult males are to hand of *N. difficilis*, and a good number from various parts of the North Atlantic of *N. megalops*.

In both species the terminal process has its proximal part directed somewhat outwards, and then the process

is abruptly somewhat bent, with the distal part longer and more slender than the proximal and flatly curved with the concave outer margin serrate, in *N. megalops* to the bend, in *N. difficilis* to a little from the bend (Fig. 18); the proximal saw-teeth are fine and the distal much larger in both species. But in *N. difficilis* the serrate part is slightly more than half, in *N. megalops* considerably more than

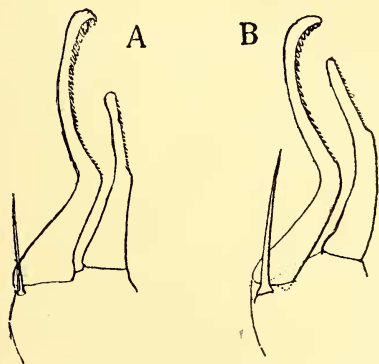


FIG. 18. A. Inner lobe with its three processes of *Nematoscelis megalops* G. O. S. B. Inner lobe of *N. difficilis* n. sp.

half, of the inner margin ; furthermore the saw-teeth in *N. megalops*, in which 44 were found, are much more numerous and especially along the more proximal portion placed much more closely together than in *N. difficilis*, in which I found 27 saw-teeth. In both species the proximal process is shorter than the terminal, with its distal part slender, straight and finely serrate along its outer margin, but in *N. difficilis* the serrate part is much less, in *N. megalops* only a little less, than half of the inner margin of the process, and what is of special importance, in *N. megalops* this process reaches at most the middle of the serrate margin of the terminal process, but in *N. difficilis* much beyond the middle of that distal part. The last-named character is easily seen by cautiously unrolling a copulatory organ under a dissecting microscope without separating it from the animal.

The female *N. megalops* has a very long and thin rostral process which is wanting in the male. The female of *N. difficilis* has a rostrum shaped as in the other species, while the three males differ strongly from each other in this respect ; in one male the rostrum is shaped as in the female, in another only a short triangular projection is found completely as in the male of *N. megalops*, while in the third specimen the end of the triangle is a little produced, thus showing a quite short, slender process.

The largest specimen of *N. difficilis* in an immature male, 21 mm. long. — This species inhabits the northern temperate East Pacific.

GROUP B.

This group comprises four species : *N. atlantica* H. J. H., *N. microps* G. O. S., *N. gracilis* H. J. H. and *N. tenella* G. O. S. The « Siboga » report contains a sufficient account of these species, together with notes on synonymy, etc.

Netomabrachion Calm.

To Calman's description a few remarks may be added. Eyes divided into two areas, the upper area broader than the lower. Antennular peduncles similar in both sexes, their two distal joints at least somewhat robust. Maxillulæ with or without pseudexopod. Sixth pair of thoracic legs with full number of joints in the endopod of both sexes. Copulatory organs with all five processes typically found in *Thysanopoda* well developed.

By most of these characters the genus differs considerably from the other genera with one pair or two pairs of elongate legs. The genus comprises 3 species, all nearly of the same size, measuring at most 21-23 mm. The following key contains the most important characters.

- a. Frontal plate obtuse, without rostral process. Eyes dark brownish ; upper section more than twice as

deep as the lower. Antennular peduncles without any process from the distal outer angle of first joint and with an at most slightly produced, acute angle above near the distal outer corner of second joint. No dorsal denticles or processes on the abdominal segments. *N. boopis* Calm.

b. Frontal plate terminating in a slender rostrum. Eyes black, with the upper section only somewhat deeper than the lower. Antennular peduncles with a long, spiniform process from the distal outer angle of first joint and with a very conspicuous process from the upper, outer angle of second joint. Conspicuous dorsal denticles on at least two abdominal segments.

α. The process from second antennular joint with at most the proximal half plate-shaped and the distal half or the major part spiniform. Third to sixth abdominal segment each with a single dorsal spiniform process from the hind margin.

N. flexipes Ortm.

β. The process from second antennular joint is a large, oblong plate slightly acuminate at the acute end. Fourth and fifth abdominal segments each with a dorsal row of three sharp denticles from the hind margin, but no denticles from the other segments.

N. sexspinosus n. sp.

N. boopis Calm. is widely distributed in the Atlantic and known from the Indian Archipelago (« Siboga ») and the Pacific (Ortmann; Agassiz Exp.).

N. flexipes Ortm. occurs in the tropical and temperate North Atlantic and the tropical East Pacific.

N. sexspinosus n. sp. seems to be rare; I have seen only three specimens, all adult males, two from the tropical East Pacific (Agassiz Exp. Stat. 4699) and the third from the temperate North Atlantic (Monaco, Stat. 2105).

Stylocheiron G. O. S.

To Sars' diagnosis of this genus some additions and corrections may be made.

The antennulæ in the female with the two distal peduncular joints slender and long or extremely long; in the males these joints, and especially the third, shorter and much thicker; the flagella with only from 6 to 10 joints which in the females are slender and round; in the males the basal joint of the lower flagellum is long and gradually much thickened towards the base, and in most species the major distal part of both flagella is distinctly flattened and frequently expanded, in some species (*S. carinatum*, *S. maximum*, *S. abbreviatum*) even much expanded, in the upper flagellum depressed, in the lower compressed. In the female the endopod of fifth pair of legs is moderately long, three-jointed, the endopod of sixth pair much longer than the small exopod, two-jointed; in the male the endopod of sixth pair is always wanting, while in fifth pair it seems to be wanting, f. inst. in *S. longicorne*, or developed as in the female in *S. maximum*. The characteristic male copulatory organs were described in the « Siboga » report (p. 80).

The genus comprises 9 species: *S. carinatum* G. O. S., *S. insulare* H. J. H., *S. microphthalma* H. J. H., *S. affine* H. J. H., *S. Suhmii* G. O. S., *S. longicorne* G. O. S., *S. elongatum* G. O. S., *S. maximum* H. J. H. and *S. abbreviatum* G. O. S. As to *S. elongatum* the « Challenger » report may be sufficient for the recognition; the other eight species have been treated in the « Siboga » report, and to the characterization of the species I have nothing of importance to add, but it may be mentioned that all species enumerated excepting *S. insulare* H. J. H. are found in the tropical East Pacific (Agassiz Exp.). A detailed study of some of the thoracic legs promises results of interest, but it must be postponed to the report on the Monaco collection.

LIST OF LITERATURE

The following list is very far from exhaustive, but it enumerates the papers containing more detailed descriptions or especially good figures of at least one and generally some or several species. The purpose is to furnish the student with references to papers which, according to my opinion, will be most useful for the determination of species; in this connection no attention is paid to the first description of a species, if it does not happen to be the best. Besides such papers I found it useful, for the sake of synonymy or utterances in this paper, to include some quite small contributions of Brandt, Illig and Ortmann.

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